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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/670,189	09/26/2000	Gary Eugene Wheat	13DV13658	5616

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EXAMINER

CLEVELAND, MICHAEL B

ART UNIT PAPER NUMBER

1762

DATE MAILED: 04/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/670,189

Applicant(s)

WHEAT ET AL.

Examiner

Michael Cleveland

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 February 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 9 and 20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 9 and 20: The phrase “the step of contacting the coating source” is unclear because it does not have antecedent basis in the parent claim. Based on Applicant’s comments on p. 4 of the response, the phrase may be intended to require that “the step of providing a coating source includes the step of providing the solid fluoride or iodide of the modifying element applied directly to the article surface”. If so, the examiner recommends the adoption of such language. Currently, the claims are treated as open to any contact of the fluoride or iodide to the surface, which is a necessary feature of the process of claim 1. However, the apparently intended limitation has also been addressed by art.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

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invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-2 and 4-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Warnes et al. (U.S. Patent 5,989,733, hereafter '733) in view of Basta et al. (U.S. Patent 5,261,963, hereafter '963) and Smith et al. (U.S. Patent 4,180,400, hereafter '400).

Claims 1, 4-5, 10-11: '733 teaches a CVD method

providing an article with a surface (col. 5, lines 46-67);

preparing a coating source (col. 6, lines 5-37) which comprises aluminum trichloride (i.e., an aluminum halide) (col. 6, lines 6-9), hafnium tetrachloride (i.e., a chloride of a modifying element) (col. 6, line 10), zirconium tetrachloride (i.e., a chloride of a modifying element) (col. 6, lines 10), and argon (i.e., a carrier gas (col. 6, lines 9-10);

contacting the coating source to the article (col. 6, lines 32-34); and

heating the coating source and the article to a coating temperature of 1080 °C (1976 °F) (col. 6, lines 5-6) for a period of time to permit aluminum and the modifying element(s) to coat onto the surface of the article (col. 6, lines 32-34).

'733 does not explicitly teach the use of solid metal halides. '733 teaches providing the metal chloride CVD precursors by flowing HCl over/through samples of the metals (col. 6, lines 12-32). However, '400 teaches that metal halides, including aluminum chloride, may be formed by evaporation of the solid metal halide or by reaction of aluminum with HCl (col. 5, lines 15-28). Therefore, '400 demonstrates the equivalence of physical evaporation and reaction of metal with HCl to form metal halide CVD precursors. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided the metal halide precursors by physical evaporation instead of by reaction of metal with HCl with a reasonable expectation of success and with the expectation of similar results because the substitution of one art-recognized equivalent for another has been held to be *prima facie* obvious. See MPEP 2144.06.

'733 does not explicitly teach the use of a fluoride or iodide of the modifying element.

'400 teaches the use of other halides as equivalent CVD precursors (col. 3, lines 26-28), but does not explicitly teach fluoride or iodides. However, '963 (which is referenced in '733, col. 5, lines 46-53) teaches that instead of forming metal chlorides as CVD precursors by such a method,

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metal fluorides, including those of aluminum, hafnium, and zirconium, may be used as CVD precursors. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided the metal fluorides of '963 in place of the metal chlorides of '733 with the expectation of similar results and with a reasonable expectation of success.

Claim 2: The article is provided with a platinum-enriched surface region (col. 5, lines 53-56).

Claims 6-7: The source may broadly include the solid aluminum, hafnium, and zirconium over/through which the HCl or HF is flowed ('733, col. 6, lines 12-32). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have combined the prior art methods of physical evaporation of metal halide and reaction of solid metal with HF (See '963, col. 4, lines 21-48; col. 9, lines 19-32 with a reasonable expectation of success and with the expectation of similar results because the combination of equivalents has been held to be a *prima facie* case of obviousness. See MPEP 2144.06.

Claim 8: The hafnium or zirconium fluoride is initially provided in the immediate vicinity of the hafnium/zirconium bed(s). These beds do not appear to be on the substrate, and therefore are separated from the substrate.

Claim 9: The precursor then flows to (i.e., is applied to) the substrate.

6. Claims 3 and 12-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Warnes '733 in view of Basta '963 and Smith '400 as applied to claim 1 above, and further in view of Basta et al. (U.S. Patent 5,658,614, hereafter '614).

Claims 3 and 12: '733, '963, and '400 teach the application of platinum aluminide coatings, as described above. They are applied to nickel-base superalloys ('733, col. 3, lines 43-47) and are of interest in the application to turbine blades ('733, col. 1, lines 59-67). They do not explicitly teach that the substrate is an airfoil.

'614 (which is specifically mentioned in '733, col. 2, lines 14-19 teaches that airfoils benefit from CVD applied platinum aluminide coatings (col. 3, lines 25-37). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have

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used the method of '733 and '963 on an airfoil as the particular turbine engine component to receive the coating because '614 teaches that airfoils benefit from such coatings.

Claims 13: The article is provided with a platinum-enriched surface region (col. 5, lines 53-56).

Claims 14-16: The references fairly teach zirconium tetrafluoride, hafnium tetrafluoride, and aluminum trifluoride, as described regarding claims 1, 4, and 5, above.

Claims 17-18: The source may broadly include the solid aluminum, hafnium, and zirconium over/through which the HCl or HF is flowed ('733, col. 6, lines 12-32).

Claim 19: The hafnium or zirconium fluoride is initially provided in the immediate vicinity of the hafnium/zirconium bed(s). These beds do not appear to be on the substrate, and therefore are separated from the substrate.

Claim 20: The precursor then flows to (i.e., is applied to) the substrate.

Claim 16: '733 does not explicitly teach a ratio of AlF_3 to ZrF_4 of between 1.4 and 3 (which corresponds to a molar ratio of Al to Zr of 2.7-6). However, it is the Examiner's position that the range of the molar ratio of Al to Zr overlaps that effectively claimed by Applicant, as described in greater detail as follows:

The Example of '733, col. 6, lines 5-37 provides Hf as the major modifying element. It is clear that this amount of Hf satisfies the desired weight ratio of the abstract (0.01-8 wt. %). It is also clear from the abstract Zr may be supplied in the same weight amount of 0.01-8 wt%. However, because Hf (MW=178.5) has a molecular weight approximately twice that of Zr (MW=91.2), approximately twice as many moles will be necessary to provide the same weight. In the Example of '733, col. 6, lines 5-37, the molar ratio approximately corresponds to the volumetric ratio of the gases (assuming the gases behave as ideal gases). The flow is 4% of a mixture that is >90% aluminum trichloride (i.e., about 3.6 vol. % and therefore about 3.6 mol % AlCl_3) and about 1.5 vol % (and therefore mol %) HfCl_4 . As stated above, it would take approximately twice as many moles of ZrCl_4 (or ZrF_4) to produce the same weight of Zr as Hf in the coating. Thus, 3.0 vol. % ZrCl_4 or ZrF_4 would have been necessary to produce the same weight. Therefore, the molar ratio of Al/Zr for this embodiment is approximately $3.6/3.0=1.2$.

The literal teaching of col. 6, lines 5-37 suggests a much higher ratio (3.6 vol. % AlCl_3 /(1% (col. 6, lines 28-32) of the 1.5 vol. % $\text{HfCl}_4/\text{ZrCl}_4$ mixture)= $3.6/0.015=240$.

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Therefore, it is the Examiner's position that '733 fairly suggests molar ratios of Al/Zr covering at least the range 1.2 to 240. The subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected the overlapping portion of the range disclosed by the reference because overlapping ranges have been held to be a *prima facie* case of obviousness, see *In re Malagari*, 182 U.S.P.Q. 549.

7. Claims 1, 3, 5-7, 9, 11-12, 15, 17-18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. (U.S. Patent 3,951,642, hereafter '642), Speirs et al. (U.S. Patent 4,066,806, hereafter '806), Bornstein et al. (U.S. Patent 4,142,023, hereafter '023).

Chang '642 teaches a pack diffusion method of coating article, comprising the steps of providing the article having a surface (col. 3, line 643-col. 5, line 10);

preparing a coating source containing aluminum, solid ammonium fluoride, and solid hafnium tetrafluoride (col. 4, lines 1-37) by providing the coating source to the article surface; and

heating the article to a coating temperature of 1900-1950 °F for a period of time sufficient to permit aluminum and the modifying element to coat onto the surface of the article (col. 4, lines 38-68).

'642 does not explicitly teach that the coating source includes an aluminum halide or a carrier gas nor that a coating gas from the coating source.

'642 teaches the inclusion of ammonium fluoride (e.g., col. 4, lines 8), a commonly known energizer in the powder pack. '806 teaches the equivalence of ammonium halide and aluminum halides as energizers in aluminum pack diffusion (col. 3, lines 47-63). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the aluminum halide of '806 for the ammonium halide of '642 with a reasonable expectation of success and with the expectation of similar results because the substitution of one art recognized equivalent for another has been held to be *prima facie* obvious.

'642 is silent as to the atmosphere and therefore does not teach a carrier gas. However, '023 teaches that the environment for pack diffusion processes may be air or inert gas (i.e., carrier gases). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have conducted the pack diffusion process of '642 in the presence of such

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a carrier gas because '023 teaches that such gases are operative environments for pack diffusion aluminizing.

The references do not explicitly teach that the coating source vaporizes. However, the current application and Spiers (U.S. 3,764,373) both reveal that the temperatures of '642 are above the vaporization temperature of the hafnium and aluminum halides. Therefore, they hafnium and aluminum halides would necessarily have vaporized and formed part of a coating gas during the process.

Claim 3: The coating may be used on nickel-base superalloys ('642, col. 3, lines 63-65).

Claims 3, 12: The coating may be used for airfoils ('806, col. 2, lines 55-68).

Claims 6 and 17: Such packs may comprise solid aluminum ('023, Example 2).

Claims 7 and 18: The source may include metallic Hf (col. 4, lines 33-37).

Response to Arguments

8. Applicant's arguments filed 2/27/2003 have been fully considered but they are not persuasive.

Applicant's arguments and amendments regarding the rejections of claims 1, 3, 7, 8, 12, 18, and 19 under 35 USC 112, 1st paragraph are convincing and the rejections are withdrawn. Applicant's arguments regarding claims 9 and 20 are not convincing because the claims do not conclusively recite that the solid fluoride or iodide is brought in contact with the surface, as discussed above.

Applicant's arguments regarding the new limitation of solid metal halide precursors is noted, but is unconvincing in view of the newly cited art (Smith '400).

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kurita et al. (U.S. Patent 4,665,040) and Yamamoto et al. (U.S. Patent 4,901,669) are cited to demonstrate physical evaporation of Hf and Zr halides. Speirs et al. (U.S. Patent 3,764,373, hereafter '373) is cited for its teachings regarding the formation of gas during pack diffusion processes.


11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Cleveland whose telephone number is (703) 308-2331. The examiner can normally be reached on 9-5:30 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 306-3186 for regular communications and (703) 306-3186 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



MBC
April 21, 2003



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